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THE EFFECTS OF SUBURBANIZATION AND HAYING ON THE REPRODUCTIVE SUCCESS OF GRASSLAND BIRDS BREEDING IN HAYFIELDS IN BOULDER, COLORADO

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ABSTRACT

Grassland bird populations across North America are declining rapidly. I examined the effects of landscape context and haying schedule on the breeding success of birds breeding in hayfields during 1998 in Boulder, Colorado. Birds breeding in hayfields near suburban edges did not have significantly different reproductive success (32%) than birds breeding in hayfields remote from suburban edges (27%). Predation rates also did not differ significantly, causing 40% of all nest failures in adjacent sites and 35% of all nest failures in remote sites. Mowing occurred in late June and early July, destroying 26% of all nest attempts.

INTRODUCTION

Over the last thirty years grassland birds have exhibited more extensive population declines than any other behavioral or ecological group of species in North America (Askins, 1993; Kerschner and Bollinger, 1996; Herkert, 1995; Line, 1997). Habitat degradation and fragmentation, an increase in predator populations, nest parasitism, and changing land-use practices may all contribute to this decline (Askins, 1993; Herkert 1995; Kerschner and Bollinger; 1996 Vierling 1997). On a large scale the decline in grassland bird population may be primarily attributable to an increase in agricultural land use and urban sprawl, reducing and fragmenting native grasslands all across North America, resulting in an overall loss of suitable habitat (Herkert 1995). As a result grassland birds persist locally in high densities on "substitute grasslands," such as pastures and hayfields. However the land available for substitute grasslands is generally of lower quality for nesting than are the native grasslands due to high levels of disturbance from edge effects and/or mowing and grazing practices (Kerschner and Bollinger, 1996).

Edge effects caused by landscape context may have a large effect on the reproductive success of grassland birds breeding in hayfields. Hayfields near suburban edges may experience different levels of breeding success due to increased nest predation than do the hayfields remote from such edges. Wilcove (1985) demonstrated that nest predation rates were higher in forest plots near suburban edges compared to remote forest plots. He suggests that this was the result

of a higher density of human commensal predators in suburban edges. The results of this study suggest that this may also be true for grassland birds breeding in hayfields near suburban edges. Indeed this was also supported by Vierling (1997) who demonstrated that predation rates differed significantly among hayfields adjacent to suburban edges and those remote from suburban edges.

Mowing of hayfields also has a large potential to effect reproductive rates of nesting birds due to the near complete destruction it causes to nesting habitat. The amount of impact from haying depends on the haying schedule, length and duration of the breeding cycle, phenology of breeding and the likelihood of the species to renest (Vierling 1997). Herkert (1997) and Bollinger (1990) document the negative effects of haying on the nesting activities of bobolink (Dolichonyx oryzivorus) and attribute much of the species' population decline of 90% between 1966 and 1992 to haying.

The objectives of this study were: (1) to determine the effects of landscape context on the breeding success of grassland birds breeding in hayfields; (2) to determine the impact that mowing practices have on grassland bird productivity; (3) to aid in devising management strategies that will enhance the productivity of grassland birds breeding in hayfields in Boulder, Colorado.

METHODS

STUDY SITES AND SPECIES

Sixteen hayfields operated by the City of Boulder Open Space Department were monitored for breeding bird activity. Eight hayfields located adjacent to suburban edges and eight hayfields located far from suburban edges were chosen for this study. Of the sixteen sites, breeding birds were found in only nine; three adjacent and six remote. A total of 81 nests were monitored over the breeding season; 22 in adjacent sites and 59 in remote sites. All species of

birds to nest in the hayfields were monitored. The species assemblage consisted of red-winged blackbird (*Agelaius phoeniceus*), bobolink (*Dolichonyx oryzivorous*), western meadowlark (*Sturnella neglecta*), wilson's phalarope (*Steganopus tricolor*), and mallard (*Anas platyrhynchos*).

NEST SEARCHING AND MONITORING

I searched for nests from 12 May, 1998 to 10 July, 1998. Each hayfield was searched at least once per week and usually twice, if time permitted. Nests were located primarily by observation of parental activity and secondarily by the rope-drag method (Vierling 1997). In each case I would walk through the fields flushing incubating birds off their nests. I also followed adults that were feeding nestlings or carrying nesting material. Once found, the nests were numbered and marked with flagging tape. Because predators may potentially use flagging tape as a cue to find nests (Vierling 97) the tape was not placed at the nest directly, but instead tied to vegetation roughly five meters north of the nest. I monitored nests every two to three days to record the nest contents and status.

MEASUREMENTS OF REPRODUCTIVE ACTIVITIES

I considered a nest successful if at least one offspring fledged. Unsuccessful nests were categorized as either abandoned, submerged, mowed, or preyed upon. I categorized a nest as abandoned if all the hatchlings died in the nest or if the eggs were in the nest for greater than three weeks without hatching. I categorized a nest as a predation event if the entire contents of the nest disappeared prior to fledging. I categorized a nest as submerged if the entire contents of the nest were submerged under water for any length of time. I categorized nests as mowed when the entire nest and/or contents of the nest were destroyed during haying activities. I also categorized brood parasitism events if a brown-headed cowbird (*Molothrus ater*) egg was found in a host

nest.

DATA ANALYSIS

Reproductive success was determined by using the Mayfield method (1975). This method effectively calculates nest success by comparing the number of days nests have survived to the number of days necessary to successfully fledge young. Reproductive success and predation rates between remote and adjacent hayfields were compared using a chi-square contingency test (Bluman, 1992). Although haying resulted in many nest failures, no statistical tests were performed on its effect on reproductive success.

RESULTS

A total of 81 nests were monitored, representing five different grassland species (Table 1). Of these 81 nests, 58 failed. Mowing and Predation were the leading causes of failure, each causing 26% of the nests to fail (Table 2). Abandonment was the next leading cause of failure at 12%. Submersion by irrigation caused only 7% nest failure and occurred only in remote sites due to irrigation schedule. Nest success for all species combined was 28.4% and ranged from 0% (western meadowlark and wilson's phalarope) to 75% (bobolink).

Table 1. Overall reproductive success of birds breeding in hayfields adjacent to suburban edges and remote from suburban edges.

Hayfields ADJACENT to suburban edge			Hayfields REMOTE from suburban edge		
Species	Number of Nests	Percent Reproductive Success	Species	Number of Nests	Percent Reproductive Success
Red Winged Blackbird	13	21.43	Red Winged Blackbird	51	29.41
Wilson's Phalarope	4	0.0	Western Meadowlark	2	0.0
Mallard	1	100.0	Mallard	6	16.66
Bobolink	4	75.00			
TOTAL	**21**	**31.82**	**TOTAL**	**59**	**27.12**

Table 2. Breakdown of breeding success of nests in hayfields adjacent to suburban edges and remote from suburban edges.

Hayfields ADJACENT to suburban edges			Hayfields REMOTE from suburban edges		
Nest Result	Number of Nests	Percent of Adjacent Nests	Nest Result	Number of Nests	Percent of Remote Nests
Successful	7	31.82	Successful	16	27.12
Abandoned	4	18.18	Abandoned	6	10.17
Submerged	0	0	Submerged	6	10.17
Predation Event	6	27.27	Predation Event	15	25.42
Mowed	5	22.73	Mowed	16	27.12

Reproductive success did not differ significantly among birds breeding in hayfields adjacent to suburban edges and those breeding in hayfields remote from suburban edges ($\chi^2 = .17$, $p > 0.99$). In adjacent sites, 31.8% of all nests were successful. In remote sites 27.1% of all nests were successful (Table 1). This result is not typically supported by the recent literature (Vierling, 1997; Wilcove, 1985). Some factors that were not examined, but may in part account for this discrepancy are: inclement weather conditions (Sauer, 1996), predator population (Wilcove, 1985), successional changes in habitat (Bollinger, 1995), habitat area (Vickery et al, 1994), and vegetative composition of hayfields (Kerschner and Bollinger, 1996), i.e. percent grass cover, percent clover cover, percent forb cover, density, etc. Each of these factors may, in varying degrees, effect reproductive success.

Landscape context did not appear to have any effect on nest result whatsoever ($\chi^2 = 3.34$, $p > 0.99$). Predation rates in 1998 did not differ significantly among nests in hayfields adjacent to suburban edges and those remote from suburban edges ($\chi^2 = .04$, $p > 0.99$). This alone may be the main factor in determining the effect that landscape context has on nesting success (Wilcove, 1985; Vierling, 1997)). Sauer and Pendleton (1996), however demonstrated by analysis of Breeding Bird Survey (BBS) data that the predation effect on songbird population may in fact be weaker than previously suggested.

DISCUSSION

With the rapid decline of grassland bird populations in the past thirty years, anthropogenic grassland habitats such as hayfields are becoming increasingly valuable to the management of these species. In some regions these substitute grasslands are the only available habitats for grassland species. The Open Space sites in Boulder represent suitable habitat for at least some of

these grassland birds. While landscape context did not have a significant effect on their reproductive success in 1998, it did have a significant effect in 1997 (Vierling). Statistical analysis of the 1997 data combined with the 1998 data may yet reveal a trend toward reduced success and increased predation in adjacent fields. In addition, I recommend a third year of the study be carried out in 1999 primarily to increase the relatively small sample size.

Twenty-six percent of nests were lost due to untimely mowing, equal to the percentage of nests lost to all forms of predation combined. Nests were destroyed by mowing on two occasions, 25 June and 4 July. Unfortunately these dates were too early to allow nesting cycles to reach completion. To reduce the impact of mowing, haying schedules may be adjusted to prevent destruction of the nests. Management of haying activities according to nest status within the hayfields on a site by site basis may be necessary to increase nest production.

Among the species most susceptible to haying activities is the bobolink. The bobolink is of particular interest to management strategies because of its extreme population decline during the past thirty years and its unfortunate habit of breeding late in the summer when much of the mowing typically occurs. Already, Open Space is actively managing several sites for increased reproductive success by timing the haying schedule according to the breeding cycle of the bobolink, as well as closing known bobolink nesting sites to the public. This year sites with high bobolink activity were not mowed until the young had fledged and parental activity had ceased. In sites managed in this way, I observed no bobolink nests lost to mowing.

LITERATURE CITED

Askins, R.A. 1993. Population Trends in Grassland, Shrubland and Forest Birds in Eastern North America. Current Ornithology. 11: 1-34.

Bluman, Allan G. 1992. Elementary Statistics. Wm. C. Brown Publishers.

Bollinger, Eric K. 1995. Successional Changes and Habitat Selection in Hayfield Bird Communities. American Ornithologists' Union. v112 n3: 720-731.

Herkert, James R. 1995. An Analysis of Breeding Bird Population Trends, 1966-1993. American Midland Naturalist. July v134 n1: 41-52.

Herkert, J. R. 1997. Bobolink (*Dolichonyx oryzivorous*) Population Decline in Agricultural Landscapes in Midwestern USA. Biological Conservation. 80 (1): 107-112.

Kerschner, Eric L. and Bollinger, Eric K. Reproductive Success of Grassland Birds at East-Central Illinois Airports. American Midland Naturalist. Oct. v136 n2: 358-367.

Line, Les. 1997. Twilight of Americas Grasslands. National Wildlife. April-May. V35 n3: 20-31.

Mayfield, H. 1975. Suggestions for Calculating Nest Success. Wilson Bull. 87: 456 - 166.

Sauer, J. R. and Pendleton, G. W. Evaluating the Population Change in North American Insectivorous Songbirds. Conservation Biology. 10 (2): 465-478.

Vickery, et al. 1994. Effects of Habitat Area on the Distribution of Grassland Birds in Maine. Conservation Biology. 8 (4): 1087-1097.

Vierling, Kerri T. 1997. The Effects of Suburbanization on the Reproductive Success of Grassland Birds Breeding in Hayfields. Open Space Department, City of Boulder.